Chevron Mining Inc.
Washington Remediation Project
1217 West Wayne Street
Washington, PA 15301
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November 21, 2007

Mr. James Webb
Project Manager
U.S. Nuclear Regulatory Commission
Mail Stop T-7E-18
Washington, D.C. 20555-0001

RE: Project Execution Methodology
Washington, PA Decommissioning Project
License Number SMB-1393

Dear Mr. Webb:

Pursuant to your request, we are writing this letter as a follow-up to the November 13, 2007 meeting between members of the Nuclear Regulatory Commission (NRC) staff and the remedial construction management staff for Chevron Mining, Inc.'s Washington, PA Decommissioning Project site. As you know, Molycorp, Inc. recently was merged into Chevron Mining, Inc. (Chevron Mining), resulting in a name change from Molycorp to Chevron Mining.

Chevron Mining is decommissioning the site in accordance with the Molycorp Washington, PA Facility Decommissioning Plan Part 1 Revision (DP) (June 30, 1999) which was approved by NRC on August 8, 2000, as well as the Technical Basis Document on Classifying Areas, Release Criteria and Final Status Surveys (Technical Basis Document) prepared by Malcolm Pirnie, Inc. The Technical Basis Document was submitted to the NRC in February 2005 and was thereafter approved by the NRC in June 2005. As we discussed at the meeting, decommissioning has proceeded in accordance with the SDMP Action Plan unrestricted release criteria, utilizing survey methods in accordance with NUREG/CR-5849. The DP also allows use of the AAR method to derive subsurface release criteria. Derivation and application of AAR soil averaging guidelines are described in the Technical Basis Document.

All of the licensed material contained on this site was generated by a single manufacturing process conducted at the Molycorp facility from 1964 through 1970, and thus represents a single waste stream. Evaluation of characterization data by Malcolm Pirnie confirmed that the average

concentration of the material to be disposed off site would meet the definition of exempt material in 10 CFR 40.13 (less than 0.05% by weight source material) and therefore is suitable for disposal at a RCRA-permitted disposal facility such as the US Ecology Grand View, Idaho facility. The Technical Basis Document described stockpiling materials with residual levels of radioactivity acceptable for subsequent return to excavations based upon satisfying the established AAR release criteria. This document also addressed stockpiling materials which do not meet the AAR release criteria and must be disposed at an off site facility, as well as combining disposal material from different excavation layers. The Technical Basis Document, and in particular the stockpiling and combining disposal materials from different excavation layers, was approved in writing by the NRC in the above referenced June 21, 2005 letter before any such activities took place at the site.

Radiological excavations are being conducted in 6-inch cuts, and the excavation materials are stockpiled based upon thorium concentration range mapping. The stockpiles are thereafter characterized by high resolution gamma spectroscopy to establish thorium, uranium and radium concentrations. Some of the stockpiles are potentially suitable for use as backfill in excavations. Other stockpiles consist of material which must be exported to an off site disposal site. Consistent with the approved Technical Basis Document, Molycorp has been recombining materials from the stockpiles at the time of loading for transshipment, in a ratio intended to achieve, for each gondola car, an aggregation that is as close to the WAC as reasonably practicable, so as to minimize the amount of materials that must be sent off-site for disposal.

We trust that this information resolves any outstanding issues with respect to the above-referenced activities at the site. Accordingly, we would like to confirm our discussions on November 13 that the above-described materials management practices are acceptable to the NRC.

Pursuant to your request, Chevron Mining has performed and is submitting with this letter, two dose analyses which determine the potential dose consequences to both members of the public and the maximally exposed occupational worker from the transport to and disposal of this material at the US Ecology RCRA facility in Grand View, Idaho.

Based on the two dose assessments provided with this letter, the dose to members of the public and the maximally exposed occupational worker from the transportation and disposal of this waste at the US Ecology Grand View, Idaho facility, are well below the 100 millirem per year (mrem/yr) public dose limit and the 25 mrem/yr unrestricted use limit in 10 CFR 20, Subpart E and below the 15 mrem/yr unrestricted use criterion under IDAPA 58.01.10.

If you have any further questions, or would like any additional materials or information, please let us know.

Respectfully Submitted,

CHEVRON MINING, INC.

John C. Wright, Jr.
Project Site Manager

MALCOLM PIRNIE, INC.

Alan J. Shuckrow, Ph.D
Project Manager

Attachments:

1) Rail Transportation Dose Assessment
2) Disposal Site Dose Assessment

cc: George Dawes, Chevron EMC
Mark Lafferty, Chevron EMC
Eve W. Baron, Chevron
Randy Struk, Thorp, Reed & Armstrong

DOSE ASSESSMENT FOR DISPOSAL OF Chevron Molycorp WASTE CONTAINING LESS THAN 0.05 PERCENT BY WEIGHT

SOURCE MATERIAL AT US ECOLOGY OF IDAHO, INC. Washington, Pennsylvania Facility

Prepared for: **Chevron Molycorp**

November 20, 2007

Dose Assessment for the Transportation of Chevron Molycorp Waste Containing Less Than 0.05 Percent by Weight Source Material to US Ecology Idaho Facility

1.0 Introduction

This dose assessment was prepared at the request of Chevron Molycorp to calculate dose from radioactive material as transported from the Chevron Molycorp Washington, Pennsylvania site (the site) to the US Ecology Idaho (USEI) facility. Much of the site-specific information was provided by USEI in a dose assessment that provided the analytical basis for the permit modification to accept certain low activity radioactive material at the USEI facility, (Reference 1).

This report provides a dose assessment demonstrating that the dose to members of the public from the transportation of this waste to USEI is low compared to the 100 millirem per year (mremlyr) public dose limit, the 25 mrem/yr unrestricted use limit in 10 CFR 20, Subpart E and 15 mrem TEDE per year from release of radioactive materials for unrestricted use IDAPA 58.01.10.

The detailed assessments supporting these conclusions are presented below.

2.0 Safety Analysis and Dose Assessment for Transportation of Chevron Molycorp Waste to the US Ecology Idaho Facility

2.1 Source Term

The **Chevron Molycorp** waste contains the natural thorium decay series (thorium), the natural uranium decay series (uranium) and excess radium. Excess radium is defined as radium (Ra-226) in excess of the

natural uranium decay series activity concentration (of which Ra-226 is a member). All of the licensed material contained on this site was generated by a single manufacturing process conducted at the Molycorp facility from 1964 through 1970, and thus represents a single homogeneous waste stream. Evaluation of characterization data confirmed that, on average, the waste stream to be disposed off site meets the definition of exempt material in 10 CFR 40.13 (less than 0.05% by weight source material) and therefore is being disposed of at US Ecology, a RCRA-permitted disposal facility. The thorium concentration of the Chevron Molycorp waste stream is less than 55 pico-Curies per gram (pCi/g) Th-232, corresponding to the 0.05 wt percent. Th-228 and Th-230 are also present but because of their very high specific activity relative to Th-232 (and low percent by weight), they are not a factor in the 0.05 wt percent calculation. The uranium decay series (U-238 and U-234) is present in equilibrium at an average activity concentration equal to 50% of the Th-232 activity concentration. Since the 0.05 wt percent for uranium is equal to 167 pCi/g of U-238, the uranium activity is a small fraction in the 0.05 wt percent calculation. To meet the WAC the following sum of fractions shall be less than 1:

$$[\text{Th-232}] / 55\ \text{pCi/g} + [\text{U-238}] / 167\ \text{pCi/g} < 1$$

Ra-226 and Ra-228 are also present but not accounted for in the 0.05 wt percent concentration determination because radium is not source material as defined in 10 CFR 40. However, Ra-226 and Ra-228 are included in the dose assessment. The source term for the calculation of dose due to the transportation of Chevron Molycorp waste to USEI is as follows based on the sum of fractions result close to but not exceeding 1 and the average relative activities of the decay series on site:

- 46 pCi/g of Th-232 in equilibrium with all progeny (including Ra-228)
- 23 pCi/g of U-238 in equilibrium with all progeny (including Ra-226)
- 10 pCi/g of Ra-226 in equilibrium with all progeny

Excess Ra-228 (activity greater than the average activity concentration of the thorium decay series) is not possible because of the relatively short half-life of Ra-228 (5.8 years). Any Ra-228 separated from the thorium decay series has decayed away.

2.2 Dose to USEI Workers

US Ecology Idaho is required by condition of its Department of Environmental Quality permit to operate in a way that assures that the highest potential dose to a worker handling radioactive material is 400 mrem TEDE per year, and that assures that the highest potential dose to a member of the public is 100 mrem TEDE per year from operations or 15 mrem TEDE per year from release of radioactive materials for unrestricted use. To meet these requirements, US Ecology Idaho conducts its operations in

accordance with its Radioactive Material Health and Safety Manual and other operating procedures. These procedures include measures for minimizing release of material in receipt and handling. Workers use mechanized equipment to transfer and deposit material in the disposal cell. Materials placed in the cell are covered each day with a stabilizing layer of soil at least several inches thick to minimize the potential for release of radioactive materials to the atmosphere (Reference 3).

There are two types of activities that result in non-negligible dose to USEI workers. The first involves Radiation Protection Technicians (RPT) who survey incoming railcars and the second involves drivers that transport the waste from the rail to the facility and unload the waste. An estimate of this potential dose follows:

An RPT may require 1/2 hour to inspect and perform a survey of an incoming railcar. The average distance from the railcar is conservatively assumed to be 3 feet. The actual distance is greater since part of the time is performing a survey at 3 meters. A MicroShield (Reference 5) calculation was performed using the Chevron Molycorp waste profile and the specific dimensions of the railcars to be used for shipping the Chevron Molycorp waste (52.5 ft L x 9.5 ft W x 5 ft H). Although the railcar has a volume of 92 cubic yards (cy), it cannot be filled completely with soil-like material (density equal to 1.56 tons/cy). The railcars will hold approximately 70.5 cy of the waste material, however the MicroShield calculations are conservatively based on the source material filling the full volume of the railcar. The MicroShield report for this analysis is provided in Attachment 1.

The resulting dose per railcar survey is 3.294E-02 mrem (6.588E-02 mrem/hr x 0.5 hr). The dose for an individual radiation protection technician is calculated as follows assuming that there are four RPT at USEI that are equally likely to perform the survey, 90,000 cy of waste, and 70.5 cy per railcar:

Dose per USEI RPT = (3.294E-02 mrem per railcar) x (90,000 cy) / (70.5 cy/railcar) / (4 RPT)

=10.51 mrem per RPT

The dose to the USEI driver is also calculated using MicroShield and the Chevron Molycorp waste profile. Assuming that the dimensions of the trucks used at USEI are 25 ft L x 6 ft W x 3 ft H, they would hold a volume of 450 ft^3 (16.7 cy). The driver would be 5 feet from the waste and would require 1 hour to load the truck, transport to the disposal cell, and unload. In addition to the truck driver, dose to an excavator operator unloading the railcar into the truck is considered in this calculation. The resulting dose is 1.589E-02 mrem per load (1.589E-02 mrem/hr x 1 hr). Assuming seven drivers (USEI) that are equally likely to haul the waste, plus two excavator operators, 90,000 cy of waste, and 15.5 cy per load (using the argument above for filling the truck), the individual driver/operator dose is calculated as follows:

Dose USEI driver-operator = (1.589E-02 mrem/load) x (90,000 cy) / (15.5 cy/load) / (9 drivers/operators) = 10.25 mrem/driver-operator

The MicroShield report for this analysis is provided in Attachment 2.

2.3 Dose to Members of the Public

There are two individual members of the public that may be exposed as a result of the transport of exempt quantity waste. They are railroad crew members and other railroad employees. The dose to these members of the public are calculated below.

The Chevron Molycorp waste will be transported to USEI by rail. Individual dose was calculated for a train crewmember and a railroad employee at a rail station. All calculations were performed using MicroShield and guidance provided in NUREG-0170, Vol.1, "Final Environmental Impact Statement on the Transportation of Radioactive Material by Air and Other Modes, Table 4-9". The doses are calculated as follows:

Dose to the Public (Railroad Crew Member) = (2.589E-06 mrem/hr @ 152m) x (2,230 mi/shipment) x (256 shipments) / (25 miles/hr)

= 5.912E-02 mrem

Where:

- 2.589E-06 mrem/hr = crew member exposure rate from Chevron Molycorp waste calculated using MicroShield and assuming an average separation distance of 152 m (per NUREG-0170, Table 4-9).
- 2,230 mi = estimated distance from Chevron Molycorp, Washington Pa to USEI (Grand View Idaho)
- 256 shipments = 90,000 cy Chevron Molycorp waste / 352.5 cy per shipment (assuming 5 Chevron Molycorp cars per shipment @ 70.5 cy per car)
- 25 mi/hr = average train speed in medium-population areas (per NUREG-0170)

Dose to the Public (Railroad Employee) = (2.453E-03 mrem/hr @ 15m) x (0.25 hr/shipment) x (256 shipments) = 1.570E-01 mrem

Where: One station employee spends 15 minutes (0.25 hr) at a distance of 15 meters from a railcar (NUREG-0170, Section 4.3.3.1.3) for each of the Chevron Molycorp shipments.

The MicroShield reports for these two calculations are provided in Attachments 3 and 4, respectively.

4.0 Conclusions of Analyses

Chevron Molycorp is disposing contaminated soil from its Washington, PA facility by transfer to the US Ecology Idaho facility. Chevron Molycorp will only transfer waste containing unimportant quantities of source material, i.e., less than 0.05 wt percent. Estimates of individual dose to members of the public and to USEI workers were made to evaluate the consequence of transporting the Chevron Molycorp waste to the USEI facility. The doses are listed in Table 4.1. The derivation of the dose is based on site specific inputs and conservative assumptions.

In conclusion, the doses from the shipment of exempt Chevron Molycorp waste to USEI are below the 100 mrem/yr public dose limit and the 25 mrem/yr unrestricted use limit in 10 CFR 20, Subpart E.

Table 4.1 - Individual Chevron Molycorp Transportation Dose* .

Exposure Scenario	Individual Dose (mrem)
USEI Workers (driver/operator)	10.25
Railroad Crew Member	5.912E-02
RPT	10.51
Railroad Employee	1.570E-01

*Dose is the total for the transportation of the entire volume. Since the volume will be transported over two calendar years, the dose per year is a fraction of the total based on the fraction of the volume shipped each year. For example if 50% of the volume is transported each year, the dose per year will be one half of the Table 4.1 reported total dose.

4.0 References

1. US Ecology Idaho, Inc., 'Report on Analytical Basis for Waste Acceptance Criteria Revisions to Accept Naturally Occurring and Certain Other Low Activity Radioactive Material", 2001.

2. US Ecology Idaho, Inc, Audit Response Package 2003.

3. Mallinckrodt, Inc., "Proposal to transfer certain solid wastes from decommissioning C-T process buildings & transmittal of report, Disposal of Mallinckrodt 10 CFR Part 40 section 13(a) Material at US Ecology Idaho Site", June 2002.

4. Decommissioning Plan, Chevron Molycorp Washington, Pennsylvania Facility, May 2000.

5. MicroShield Version 6.02, Grove Engineering, Rockville, MD, 1995-99.

Attachment 1

Case 1 - Railcar RPT Exposure Rate

MicroShield File

Print

MicroShield 6.22 (6.02.0204)
Safety and Ecology Corporation

Page	1
DOS File	CM Railcar RP.ms6
Run Date	November 19, 2007
Run Time	9:33:49 AM
Duration	00:00:01

File Ref	
Date	
By	
Checked	

Case Title: Rail Car RP Run #1
Description: Chevron Molycorp Railcar RP
Geometry: 13 - Rectangular Volume

Source Dimensions:

Length	289.56 cm	(9 ft 6.0 in)
Width	1.6e+3 cm	(52 ft 6.0 in)
Height	152.4 cm	(5 ft 0.0 in)

Dose Points

A	X	Y	Z
# 1	381 cm	76.2 cm	800.1 cm
	12 ft 6.0 in	2 ft 6.0 in	26 ft 3.0 in

Shields

Shield N	Dimension	Material	Density
Source	7.06e+07 cm³	FGR 12 Soil	1.85
Shield 1	.635 cm	Iron	7.86
Air Gap		Air	0.00122

Source Input : Grouping Method - Standard Indices
Number of Groups : 25
Lower Energy Cutoff : 0.015
Photons < 0.015 : Included
Library : Grove

Nuclide	curies	becquerels	µCi/cm³	Bq/cm³
Ac-228	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Bi-210	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Bi-212	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Bi-214	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Pa-234m	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000
Pb-210	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Pb-212	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Pb-214	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Po-210	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Po-212	3.9050e-003	1.4449e+008	5.5300e-005	2.0461e+000
Po-214	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Po-216	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Po-218	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Ra-224	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Ra-226	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Ra-228	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Rn-220	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Rn-222	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Th-228	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Th-230	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000
Th-232	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000

Th-234	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000
Tl-208	2.1608e-003	7.9950e+007	3.0600e-005	1.1322e+000
U-234	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000
U-238	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000

Buildup : The material reference is - Source

Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy MeV	Activity Photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	2.863e+08	5.972e-145	2.495e-26	5.122e-146	2.140e-27
0.04	2.273e+06	3.652e-13	1.683e-12	1.615e-15	7.443e-15
0.05	8.361e+06	2.605e-08	1.914e-07	6.940e-11	5.099e-10
0.06	6.303e+06	2.014e-06	1.924e-05	4.000e-09	3.822e-08
0.08	1.329e+08	2.332e-03	2.472e-02	3.690e-06	3.911e-05
0.1	2.277e+07	2.069e-03	2.031e-02	3.166e-06	3.108e-05
0.15	9.422e+06	4.291e-03	3.199e-02	7.066e-06	5.269e-05
0.2	1.380e+08	1.267e-01	7.816e-01	2.236e-04	1.379e-03
0.3	9.092e+07	1.840e-01	8.890e-01	3.490e-04	1.686e-03
0.4	6.635e+07	2.235e-01	9.187e-01	4.354e-04	1.790e-03
0.5	3.371e+07	1.668e-01	6.096e-01	3.275e-04	1.197e-03
0.6	1.477e+08	9.982e-01	3.314e+00	1.948e-03	6.470e-03
0.8	8.617e+07	9.499e-01	2.754e+00	1.807e-03	5.239e-03
1.0	1.805e+08	2.908e+00	7.640e+00	5.361e-03	1.408e-02
1.5	6.022e+07	1.928e+00	4.324e+00	3.244e-03	7.274e-03
2.0	4.340e+07	2.236e+00	4.586e+00	3.458e-03	7.092e-03
3.0	7.979e+07	7.845e+00	1.440e+01	1.064e-02	1.954e-02
Totals	**1.395e+09**	**1.758e+01**	**4.030e+01**	**2.781e-02**	**6.588e-02**

Attachment 2

Case 2 - Truck Driver Exposure Rate

MicroShield File

Print

MicroShield 6.22 (6.02.0204)
Safety and Ecology Corporation

Page	1
DOS File	CM Truck Driver.ms6
Run Date	November 19, 2007
Run Time	10:31:50 AM
Duration	00:00:01

File Ref	
Date	
By	
Checked	

Case Title: CMTruck Run #2
Description: Chevron Molycorp Truck Driver
Geometry: 13 - Rectangular Volume

Source Dimensions:

Length	762.0 cm	(25 ft)
Width	182.88 cm	(6 ft)
Height	91.44 cm	(3 ft)

Dose Points

A	X	Y	Z
# 1	914.4 cm	45.72 cm	91.44 cm
	30 ft	1 ft 6.0 in	3 ft

Shields

Shield N	Dimension	Material	Density
Source	1.27e+07 cm³	FGR 12 Soil	1.85
Shield 1	.318 cm	Iron	7.86
Air Gap		Air	0.00122

Source Input : Grouping Method - Standard Indices
Number of Groups : 25
Lower Energy Cutoff : 0.015
Photons < 0.015 : Included
Library : Grove

Nuclide	curies	becquerels	µCi/cm³	Bq/cm³
Ac-228	1.0845e-003	4.0127e+007	8.5110e-005	3.1491e+000
Bi-210	7.7857e-014	2.8807e-003	6.1100e-015	2.2607e-010
Bi-212	1.0844e-003	4.0123e+007	8.5100e-005	3.1487e+000
Bi-214	7.7857e-004	2.8807e+007	6.1100e-005	2.2607e+000
Pa-234m	5.4283e-004	2.0085e+007	4.2600e-005	1.5762e+000
Pb-210	7.7857e-004	2.8807e+007	6.1100e-005	2.2607e+000
Pb-212	1.0844e-003	4.0123e+007	8.5100e-005	3.1487e+000
Pb-214	7.7857e-004	2.8807e+007	6.1100e-005	2.2607e+000
Po-210	7.7857e-004	2.8807e+007	6.1100e-005	2.2607e+000
Po-212	7.0466e-004	2.6073e+007	5.5300e-005	2.0461e+000
Po-214	7.7857e-004	2.8807e+007	6.1100e-005	2.2607e+000
Po-216	1.0844e-003	4.0123e+007	8.5100e-005	3.1487e+000
Po-218	7.7857e-004	2.8807e+007	6.1100e-005	2.2607e+000
Ra-224	1.0844e-003	4.0123e+007	8.5100e-005	3.1487e+000
Ra-226	7.7857e-004	2.8807e+007	6.1100e-005	2.2607e+000
Ra-228	1.0844e-003	4.0123e+007	8.5100e-005	3.1487e+000
Rn-220	1.0844e-003	4.0123e+007	8.5100e-005	3.1487e+000
Rn-222	7.7857e-004	2.8807e+007	6.1100e-005	2.2607e+000
Th-228	1.0844e-003	4.0123e+007	8.5100e-005	3.1487e+000
Th-230	5.4283e-004	2.0085e+007	4.2600e-005	1.5762e+000
Th-232	1.0844e-003	4.0123e+007	8.5100e-005	3.1487e+000

Th-234	5.4283e-004	2.0085e+007	4.2600e-005	1.5762e+000
Tl-208	3.8992e-004	1.4427e+007	3.0600e-005	1.1322e+000
U-234	5.4283e-004	2.0085e+007	4.2600e-005	1.5762e+000
U-238	5.4283e-004	2.0085e+007	4.2600e-005	1.5762e+000

Buildup : The material reference is - Source

Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy MeV	Activity Photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	5.166e+07	1.619e-113	3.903e-27	1.389e-114	3.347e-28
0.04	4.103e+05	3.156e-11	1.338e-10	1.396e-13	5.918e-13
0.05	1.509e+06	1.541e-07	1.029e-06	4.106e-10	2.740e-09
0.06	1.137e+06	3.135e-06	2.805e-05	6.227e-09	5.571e-08
0.08	2.399e+07	1.125e-03	1.256e-02	1.780e-06	1.987e-05
0.1	4.109e+06	6.411e-04	7.369e-03	9.809e-07	1.127e-05
0.15	1.700e+06	9.825e-04	9.590e-03	1.618e-06	1.579e-05
0.2	2.490e+07	2.798e-02	2.254e-01	4.939e-05	3.977e-04
0.3	1.641e+07	4.191e-02	2.476e-01	7.949e-05	4.697e-04
0.4	1.197e+07	5.273e-02	2.502e-01	1.028e-04	4.875e-04
0.5	6.082e+06	4.038e-02	1.621e-01	7.925e-05	3.182e-04
0.6	2.666e+07	2.457e-01	8.655e-01	4.796e-04	1.689e-03
0.8	1.555e+07	2.379e-01	6.968e-01	4.525e-04	1.325e-03
1.0	3.258e+07	7.321e-01	1.885e+00	1.350e-03	3.474e-03
1.5	1.087e+07	4.813e-01	1.019e+00	8.097e-04	1.714e-03
2.0	7.831e+06	5.497e-01	1.050e+00	8.501e-04	1.624e-03
3.0	1.440e+07	1.879e+00	3.203e+00	2.550e-03	4.345e-03
Totals	**2.518e+08**	**4.292e+00**	**9.634e+00**	**6.806e-03**	**1.589e-02**

Attachment 3

Case 3 - Railcar 152-meter Exposure Rate

MicroShield File

Print

MicroShield 6.22 (6.02.0204)
Safety and Ecology Corporation

Page	1
DOS File	CM Railcar Crew 152.ms6
Run Date	November 19, 2007
Run Time	9:40:40 AM
Duration	00:00:01

File Ref	
Date	
By	
Checked	

Case Title: Rail Car Run #3
Description: Chevron Molycorp Railcar Crew 152m
Geometry: 13 - Rectangular Volume

Source Dimensions:

Length	1.6e+3 cm	(52 ft 6.0 in)
Width	289.56 cm	(9 ft 6.0 in)
Height	152.4 cm	(5 ft 0.0 in)

Dose Points

A	X	Y	Z
# 1	1.68e+04 cm	76.2 cm	144.78 cm
	551 ft 2.3 in	2 ft 6.0 in	4 ft 9.0 in

Shields

Shield N	Dimension	Material	Density
Source	7.06e+07 cm³	FGR 12 Soil	1.85
Shield 1	.635 cm	Iron	7.86
Air Gap		Air	0.00122

Source Input : Grouping Method - Standard Indices
Number of Groups : 25
Lower Energy Cutoff : 0.015
Photons < 0.015 : Included
Library : Grove

Nuclide	curies	becquerels	µCi/cm³	Bq/cm³
Ac-228	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Bi-210	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Bi-212	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Bi-214	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Pa-234m	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000
Pb-210	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Pb-212	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Pb-214	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Po-210	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Po-212	3.9050e-003	1.4449e+008	5.5300e-005	2.0461e+000
Po-214	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Po-216	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Po-218	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Ra-224	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Ra-226	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Ra-228	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Rn-220	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Rn-222	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Th-228	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Th-230	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000
Th-232	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000

Th-234	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000
Tl-208	2.1608e-003	7.9950e+007	3.0600e-005	1.1322e+000
U-234	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000
U-238	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000

Buildup : The material reference is - Source

Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy MeV	Activity Photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	2.863e+08	2.561e-242	1.246e-29	2.196e-243	1.069e-30
0.04	2.273e+06	1.530e-23	8.955e-23	6.767e-26	3.961e-25
0.05	8.361e+06	1.146e-16	1.353e-15	3.052e-19	3.605e-18
0.06	6.303e+06	6.150e-14	1.201e-12	1.221e-16	2.385e-15
0.08	1.329e+08	3.362e-10	1.102e-08	5.321e-13	1.743e-11
0.1	2.277e+07	5.837e-10	2.471e-08	8.930e-13	3.780e-11
0.15	9.422e+06	2.860e-09	1.270e-07	4.710e-12	2.092e-10
0.2	1.380e+08	1.446e-07	5.513e-06	2.552e-10	9.731e-09
0.3	9.092e+07	4.347e-07	1.129e-05	8.246e-10	2.141e-08
0.4	6.635e+07	8.584e-07	1.605e-05	1.673e-09	3.128e-08
0.5	3.371e+07	9.160e-07	1.305e-05	1.798e-09	2.561e-08
0.6	1.477e+08	7.221e-06	8.272e-05	1.410e-08	1.615e-07
0.8	8.617e+07	1.027e-05	8.429e-05	1.954e-08	1.603e-07
1.0	1.805e+08	4.179e-05	2.681e-04	7.702e-08	4.942e-07
1.5	6.022e+07	4.313e-05	1.850e-04	7.256e-08	3.112e-07
2.0	4.340e+07	6.424e-05	2.185e-04	9.934e-08	3.380e-07
3.0	7.979e+07	2.953e-04	7.636e-04	4.006e-07	1.036e-06
Totals	**1.395e+09**	**4.643e-04**	**1.648e-03**	**6.877e-07**	**2.589e-06**

Attachment 4

Case 4 - Railcar 15-meter Exposure Rate

MicroShield File

Print

MicroShield 6.22 (6.02.0204)
Safety and Ecology Corporation

Page	1
DOS File	CM Railcar Crew 15m.ms6
Run Date	November 19, 2007
Run Time	9:46:08 AM
Duration	00:00:01

File Ref	
Date	
By	
Checked	

Case Title: Rail Car Run #4
Description: Chevron Molycorp Railcar Crew 15m
Geometry: 13 - Rectangular Volume

Source Dimensions:

Length	289.56 cm	(9 ft 6.0 in)
Width	1.6e+3 cm	(52 ft 6.0 in)
Height	152.4 cm	(5 ft 0.0 in)

Dose Points

A	X	Y	Z
# 1	1.79e+03 cm	76.2 cm	800.1 cm
	58 ft 8.6 in	2 ft 6.0 in	26 ft 3.0 in

Shields

Shield N	Dimension	Material	Density
Source	7.06e+07 cm³	FGR 12 Soil	1.85
Shield 1	.653 cm	Iron	7.86
Air Gap		Air	0.00122

Source Input : Grouping Method - Standard Indices
Number of Groups : 25
Lower Energy Cutoff : 0.015
Photons < 0.015 : Included
Library : Grove

Nuclide	curies	becquerels	µCi/cm³	Bq/cm³
Ac-228	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Bi-210	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Bi-212	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Bi-214	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Pa-234m	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000
Pb-210	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Pb-212	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Pb-214	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Po-210	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Po-212	3.9050e-003	1.4449e+008	5.5300e-005	2.0461e+000
Po-214	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Po-216	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Po-218	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Ra-224	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Ra-226	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Ra-228	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Rn-220	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Rn-222	4.3146e-003	1.5964e+008	6.1100e-005	2.2607e+000
Th-228	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000
Th-230	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000
Th-232	6.0093e-003	2.2235e+008	8.5100e-005	3.1487e+000

Th-234	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000
Tl-208	2.1608e-003	7.9950e+007	3.0600e-005	1.1322e+000
U-234	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000
U-238	3.0082e-003	1.1130e+008	4.2600e-005	1.5762e+000

Buildup : The material reference is - Source
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy MeV	Activity Photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	2.863e+08	1.628e-149	1.101e-27	1.397e-150	9.445e-29
0.04	2.273e+06	2.701e-14	1.256e-13	1.195e-16	5.557e-16
0.05	8.361e+06	1.886e-09	1.387e-08	5.025e-12	3.695e-11
0.06	6.303e+06	1.276e-07	1.205e-06	2.534e-10	2.393e-09
0.08	1.329e+08	1.192e-04	1.224e-03	1.886e-07	1.938e-06
0.1	2.277e+07	9.357e-05	8.798e-04	1.431e-07	1.346e-06
0.15	9.422e+06	1.713e-04	1.222e-03	2.821e-07	2.012e-06
0.2	1.380e+08	4.862e-03	2.893e-02	8.582e-06	5.106e-05
0.3	9.092e+07	6.875e-03	3.253e-02	1.304e-05	6.170e-05
0.4	6.635e+07	8.274e-03	3.358e-02	1.612e-05	6.543e-05
0.5	3.371e+07	6.150e-03	2.233e-02	1.207e-05	4.384e-05
0.6	1.477e+08	3.671e-02	1.216e-01	7.166e-05	2.373e-04
0.8	8.617e+07	3.487e-02	1.014e-01	6.632e-05	1.928e-04
1.0	1.805e+08	1.067e-01	2.820e-01	1.968e-04	5.197e-04
1.5	6.022e+07	7.095e-02	1.607e-01	1.194e-04	2.703e-04
2.0	4.340e+07	8.266e-02	1.716e-01	1.278e-04	2.653e-04
3.0	7.979e+07	2.929e-01	5.454e-01	3.974e-04	7.399e-04
Totals	**1.395e+09**	**6.514e-01**	**1.503e+00**	**1.030e-03**	**2.453e-03**